

CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

- 1 1. A method for detecting molecules, the method comprising:
 - 2 a) determining the electronic status of a semi-conductor;
 - 3 b) establishing electronic communication between the molecules and
the semiconductor;
 - 5 c) subjecting the semi-conductor to energy influx;
 - 6 d) redetermining the electronic status of the semi-conductor.
- 1 2. The method as recited in claim 1, wherein the energy level is deter-
2 mined optically.
- 1 3. The method as recited in claim 1, wherein the energy level is deter-
2 mined electrically.
- 1 4. The method as recited in claim 1, wherein the semiconductors are
2 are octahedral metal oxides.
- 1 5. The method as recited in claim 1, wherein the semiconductors are
2 metal oxides selected from the group consisting of TiO₂, VO₂, ZrO₂, Fe₃O₄, MnO₂,
3 NiO, CuO, and combinations thereof.

1 6. The method as recited in claim 1 wherein bidentate moieties are
2 positioned intermediate the molecules and the semiconductors.

1 7. The method as recited in claim 6, wherein the moieties are
2 dihydroxyl phenyls selected from the group consisting of 1,2 dihydroxyl
3 phenylamine, 1,2-dihydroxyl phenyl alanine, 1,2-dihydroxyl benzoic acid, 1,2-
4 dihydroxy glycine, 1,2 dihydroxy benzyl amine, and combinations thereof.

1 8. The method as recited in claim 1, wherein the semiconductor further
2 comprises a valence band and a conductive band, whereby the valence band
3 contains electrons.

1 9. The method as recited in claim 8, wherein the energy influx induces
2 the electrons to relocate to the conductance band.

1 10. The method as recited in claim 1 wherein the molecules are electron
2 donators.

1 11. The method as recited in claim 1 wherein the molecules are electron
2 acceptors.

1 12. A method for detecting biological molecules, the method comprising:
2 a) supplying a semi-conductor having a first energy level and a second
3 energy level and whereby the first energy level corresponds to a first optical
4 characteristic of the semi-conductor;
5 b) establishing electrical contact between the semi-conductor and the
6 molecules;
7 c) causing electrons to move from the molecule to the second energy

8 level; and

- 9 d) monitoring any change in the first optical characteristic.

1 13. The method as recited in claim 12, wherein the biological molecule
2 extracts electrons from the semi-conductor.

1 14. The method as recited in claim 12, wherein the biological molecule
2 donates electrons to the semi-conductor.

1 15. The method as recited in claim 12, wherein a bidentate moiety is
2 intermediate the semi-conductor and the biological molecule.

1 16. The method as recited in claim 12 wherein a moiety capable of
2 withdrawing electrons from the biological molecule is in electrical communication
3 with the molecule.

1 17. The method as recited in claim 12 wherein a moiety capable of
2 donating electrons to the biological molecule is in electrical communication with the
3 molecule.

1 18. The method as recited in claim 12 wherein the semiconductors
2 are octahedral metal oxides.

1 19. The method as recited in claim 12, wherein the semi-conductor is
2 between 1 and 20 nanometers in diameter.

1 20. The method as recited in claim 12 wherein the step of causing
2 electrons to move results in the formation of an oxidative region on the semi-
3 conductor.

1 21. The method as recited in claim 20, wherein the oxidative region
2 facilitates cleavage of molecules.

1 22. A method for detecting target moieties *in situ*, the method
2 comprising:

- 3 a) binding biological material to nanocrystalline semiconductor
4 particles, wherein the material has an affinity to the target moiety;
5 b) facilitating entry of the bound material into an organelle; and
6 c) subjecting the semiconductor to radiation sufficient to produce a
7 charge pair separation on the semiconductor's surface.

1 23. The method as recited in claim 22 wherein the biological material is
2 genetic material.

1 24. The method as recited in claim 22 wherein the organelle is a nucleus
2 of a cell.

1 25. The method as recited in claim 22 wherein the charge pair separation
2 is detected via Electron Paramagnetic Resonance.

1 26. The method as recited in claim 22 wherein the charge separation is
2 detected via an electronic signal.

1 27. The method as recited in claim 26 wherein the signal can be
2 amplified.